



First record of *Anelosimus jucundus* (O. Pickard-Cambridge, 1896) (Araneae, Theridiidae) in the state of Ceará, Brazil

Jober Fernando Sobczak¹, Jullyana Cristina Moura Sobczak¹, Diego Padua², Emily Oliveira Fonseca¹, Francisco Ageu de Sousa Nóbrega¹, Joedson Castro Pires¹, Márcio Lopes Faustino¹, German Antonio Villanueva-Bonilla³

1 Laboratório de Ecologia e Evolução, Instituto de Ciências Exatas e da Natureza, Universidade da Integração Internacional da Lusofonia Afro-Brasileira, Rodovia CE-060, Km 51, s/n, 62785-000, Acarape, CE, Brazil. **2** Programa de Pós-Graduação em Entomologia, Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo, 2936, Petrópolis, Manaus, AM, Brazil. **3** Programa de Pós-graduação em Biologia Animal, Instituto de Biologia, Universidade Estadual de Campinas, CP 6109, CEP 13083-970, Campinas, SP, Brazil.

Corresponding author: Jober Fernando Sobczak, jobczak@unilab.edu.br

Abstract

We present the first record for *Anelosimus jucundus* O. Pickard-Cambridge, 1896 for the state of Ceará, Brazil. We collected 22 individuals in three different ecosystems: (1) Mangrove swamps, (2) Caatinga-type desert vegetation, and (3) Montane semi-deciduous tropical forest. We corrected the misinformation of Levi's 1963 Ceará record, was actually from the state of Pernambuco. *Anelosimus jucundus* presents a wide altitudinal distribution, which indicates that this species can tolerate a variety climatic conditions and can colonize a variety of sites with different vegetation.

Keywords

Caatinga ecosystem, cobweb spiders, mangrove swamps, social spider.

Academic editor: Gustavo Silva de Miranda | Received 8 May 2019 | Accepted 3 September 2019 | Published 18 October 2019

Citation: Sobczak JF, Sobczak JCM, Padua D, Fonseca EO, Nóbrega FAS, Pires JC, Faustino ML, Villanueva-Bonilla GA (2019) First record of *Anelosimus jucundus* (O. Pickard-Cambridge, 1896) (Araneae, Theridiidae) in the state of Ceará, Brazil. Check List 15 (5): 933–936. <https://doi.org/10.15560/15.5.933>

Introduction

The family Theridiidae, also known as cobweb spiders, constitutes one of the largest families of cosmopolitan spiders, with over 2509 species in 124 genera (World Spider Catalog 2019). Theridiid spiders are three-dimensional space-web-builders (Dias et al 2009; Cardoso et al. 2011) that exhibit extreme diversity in morphology, ecology, and behavior, which make several of their species biological research models (Agnarsson 2004).

The genus *Anelosimus* Simon, 1891, contains 74 described species with most of its species occurring in

tropical or subtropical regions (World Spider Catalog 2019). In Brazil, 13 species are currently known, with five presenting a restricted distribution in Brazil (*A. dubiosus* Keyserling, 1891; *A. jabaquara* Levi, 1956; *A. pantanal* Agnarsson, 2006; *A. rabus* Levi, 1963) (Agnarsson 2005, 2006; World Spider Catalog 2019). *Anelosimus* species differ from most theridiids in lacking a colulus, but in having a pair of colular setae. They also have a characteristic pattern of coloration of the abdomen: a dark, notched, longitudinal central band, delimited by a narrow, notched, white band, and bilateral white spots distributed outside the dorsal band (Agnarsson 2006).

Specifically, *A. jucundus* Pickard-Cambridge, 1896, has been reported in the states of São Paulo and Pernambuco (Levi 1963; Gonzaga and Santos 1999).

Anelosimus spiders are particularly important because the genus contains species varying from solitary to those that show gradients of social behavior (Avilés 1997; Agnarsson 2004). Thus, the genus plays an important role in the study of sociality and its evolution (Powers and Avilés 2003; Avilés and Bukowski 2005; Agnarsson et al. 2006). The objectives of our paper is record for the first time *A. jucundus* from the state of Ceará. This extends the geographical range of the genus *Anelosimus* to the Northeast Region of Brazil.

Methods

The study was conducted in a four localities: (1) mangrove swamps in the municipality of Trairi ($03^{\circ}11'09''S$, $039^{\circ}24'24''W$; 6 m a.s.l.); (2) Caatinga-type desert vegetation in the municipality of Tururu ($03^{\circ}35'50''S$, $039^{\circ}24'06''W$; 106 m a.s.l.); (3) a protected area of FLONA (National forest) of “Chapada do Araripe” in Montane semi-deciduous tropical forest in the municipality of Crato ($07^{\circ}16'45''S$, $039^{\circ}27'12''W$; 961 m a.s.l.); and (4) Montane semi-deciduous tropical forest in the municipality of Mulungu ($04^{\circ}18'40''S$, $038^{\circ}58'05''W$; 840 m a.s.l.) in the state of Ceará, Brazil.

Our new records are based on 22 specimens (two adult male, six adult female, and 14 juveniles) manually collected during several field expeditions in the four areas in December 2016 and July 2017. The identification of the individuals was made by the expert Dr Antonio Brescovit and was based on the identification key of Agnarsson (2004, 2006). A distribution map (Fig. 1) was created using SimpleMappr (Shorthouse 2010). All specimens collected were preserved in 70% alcohol and deposited in the Arachnida collection at the Instituto Butantan, São Paulo (IBSP; curator A.D. Brescovit).

Results

New records. Brazil: Ceará • Trairi ($03^{\circ}11'09''S$, $039^{\circ}24'24''W$), IBSP 221664, 2♀, Jober Fernando Sobczak, Jullyana Cristina Moura Sobczak collectors, 17 December 2016. • Tururu ($03^{\circ}35'50''S$, $039^{\circ}24'06''W$), IBSP 221609, 1♀ and 14 juveniles, Emily Oliveira Fonseca, Francisco Ageu de Sousa Nóbrega collectors, 15 December 2016. • Crato ($07^{\circ}16'45''S$, $039^{\circ}27'12''W$), IBSP 221605, 2♀ and 1♂, Jober Fernando Sobczak, Jullyana Cristina Moura Sobczak collectors, 05 July 2017. • Mulungu ($04^{\circ}18'40''S$, $038^{\circ}58'05''W$), IBSP 221609, 2♀, Joedson Castro Pires, Márcio Lopes Faustino, 09 December 2016.

Identification. *Anelosimus jucundus* shows a relatively intermediate degree of sociality when compared with other members of the same genus. Although *A. jucundus* shows a degree of sociability, few individuals were

observed on the webs (including juvenile, female, and adult male spiders; Fig. 2A–D). According to the diagnoses by Agnarsson (2004, 2006), males of *A. jucundus* (Figs 2D, 3B) can be recognized by their tegular outgrowth on the ectal margin (a unique feature in *A. jucundus*), extending beyond the embolus base (Fig. 3D) and in having a more robust embolus fork. Females have the epiginal plates strongly ridged (Fig. 3C), and internally the sclerotized portion of the copulatory duct extends beyond the ectalmost margin of the spermatheca.

Discussion

The subsocial species *Anelosimus jucundus* has been recorded from Mexico to Argentina (Avilés 1997). In Brazil this species had only been recorded in the states of São Paulo and Pernambuco, where the record of the last state erroneously appears as “Brazil. Ceará: Serra Communaty” (Levi 1963), while “Serra Communaty” is in fact in Pernambuco. We correct this error here and extend the geographic range of *A. jucundus* to the Northeast Region of Brazil. *Anelosimus jucundus* was recorded from 6 to 961 m above sea level at the four sites where we found it. Other studies have found *A. jucundus* at various altitudes in various ecosystems. For example, this species has been reported at 1500 m in Arizona, USA (Powers and Avilés 2003), at 196 m in a tropical humid forest in Ecuador (Tapia and de Vries 1980), and at 850 m in a rainforest in Panama (Nentwig and Christenson 1986). Indeed, Agnarsson (2006) mentioned that *A. jucundus*



Figure 1. Distribution records of *Anelosimus jucundus* in the Americas. Orange circles = known records; red stars = new records.

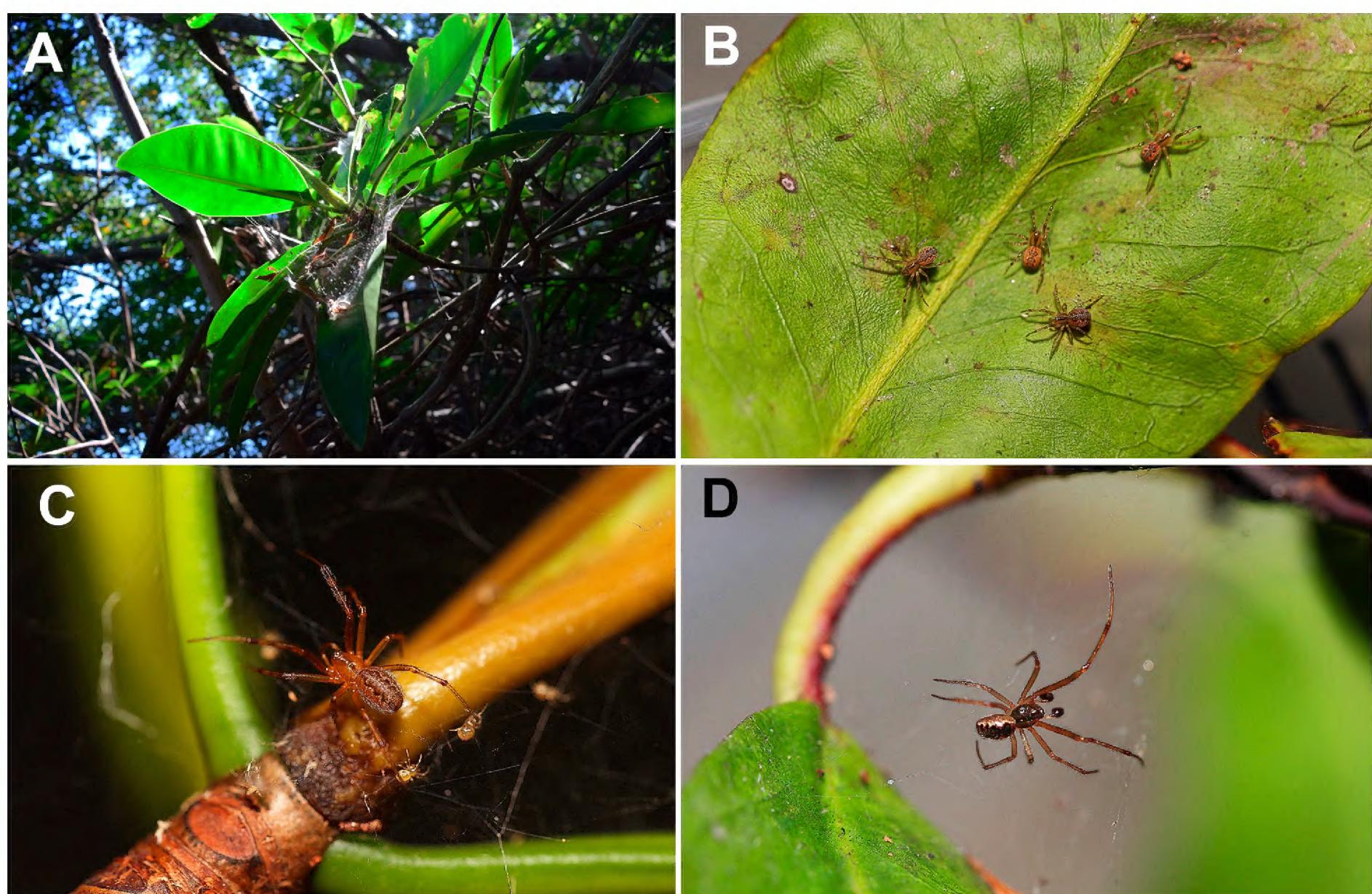


Figure 2. *Anelosimus jucundus*. **A.** Spider web of *A. jucundus*. **B.** Subadult females. **C.** Adult female with spiderling. **D.** Adult male.

has a wide altitudinal distribution from 200 to 2500 m. This suggests that *A. jucundus* tolerates a variety of climatic conditions and can colonize sites with different vegetation. However, experimental studies are necessary to know the tolerance ranges of temperature and humidity required for the survival and reproductive success of *A. jucundus*.

Acknowledgements

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES), Finance Code 001 (G.A. Villanueva-Bonilla). We were also financially supported by the Instituto Nacional de Ciência e Tecnologia dos Hymenoptera Parasitoides (HYMPAR/Sudeste – CNPq/FAPESP/CAPES), FUNCAP-BPI proc. BP3-00139-00186.01.00/18 (research grants to J.F. Sobczak). We especially thank Dr Antonio Brescovit for identifying the spiders. We also thank manuscript reviewers MSc Pedro Castanheira, Dr Ingi Agnarsson, and subject editor Dr Gustavo Silva de Miranda for the valuable corrections and suggestions made to our manuscript.

Authors' Contributions

JFS, JCMSMS, EOF, FASN, JCP, and MLF collected and photographed the specimen. DP and GAVB wrote the manuscript and, made figures. All authors discussed the final results and contributed to the final version of the manuscript.

References

- Agnarsson I (2004) Morphological phylogeny of cobweb spiders and their relatives (Araneae, Araneoidea, Theridiidae). *Zoological Journal of the Linnean Society* 141: 447–626. <https://doi.org/10.1111/j.1096-3642.2004.00120.x>
- Agnarsson I (2005) Revision and phylogenetic analysis of American *ethicus* and *rupununi* groups of *Anelosimus* (Araneae, Theridiidae). *Zoologica Scripta* 34: 389–413. <https://doi.org/10.1111/j.1463-6409.2005.00189.x>
- Agnarsson I (2006) A revision of the New World *eximus* lineage of *Anelosimus* (Araneae, Theridiidae) and a phylogenetic analysis using worldwide exemplars. *Zoological Journal of the Linnean Society* 146: 453–593. <https://doi.org/10.1111/j.1096-3642.2006.00213.x>
- Agnarsson I, Avilés L, Coddington JA, Maddison WP (2006) Sociality in theridiid spiders: repeated origins of an evolutionary dead end. *Evolution* 60: 2342–2351. <https://doi.org/10.1111/j.0014-3820.2006.tb01869.x>
- Avilés L (1997) Causes and consequences of cooperation and permanent-sociality in spiders. In: Choe JC, Crespi BJ (Eds) *The evolution of social insects and arachnids*. Cambridge University Press, Cambridge, 476–498.
- Avilés L, Bukowski TC (2005) Group living and inbreeding depression in a subsocial spider. *Proceedings of the Royal Society B: Biological Sciences* 273: 157–163. <https://doi.org/10.1098/rspb.2005.3308>
- Cardoso P, Pekár S, Jocqué R, Coddington JA (2011) Global patterns of guild composition and functional diversity of spiders. *PloS ONE* 6: e21710. <https://doi.org/10.1371/journal.pone.0021710>
- Dias SC, Carvalho LS, Bonaldo AB, Brescovit AD (2009) Refining the establishment of guilds in Neotropical spiders (Arachnida: Araneae). *Journal of Natural History* 44: 219–239. <https://doi.org/10.1080/00222930903383503>
- Gonzaga MO, Santos AJ (1999) The females of *Anelosimus dubiosus* and *Anelosimus jabaquara* (Araneae, Theridiidae). *Journal of*

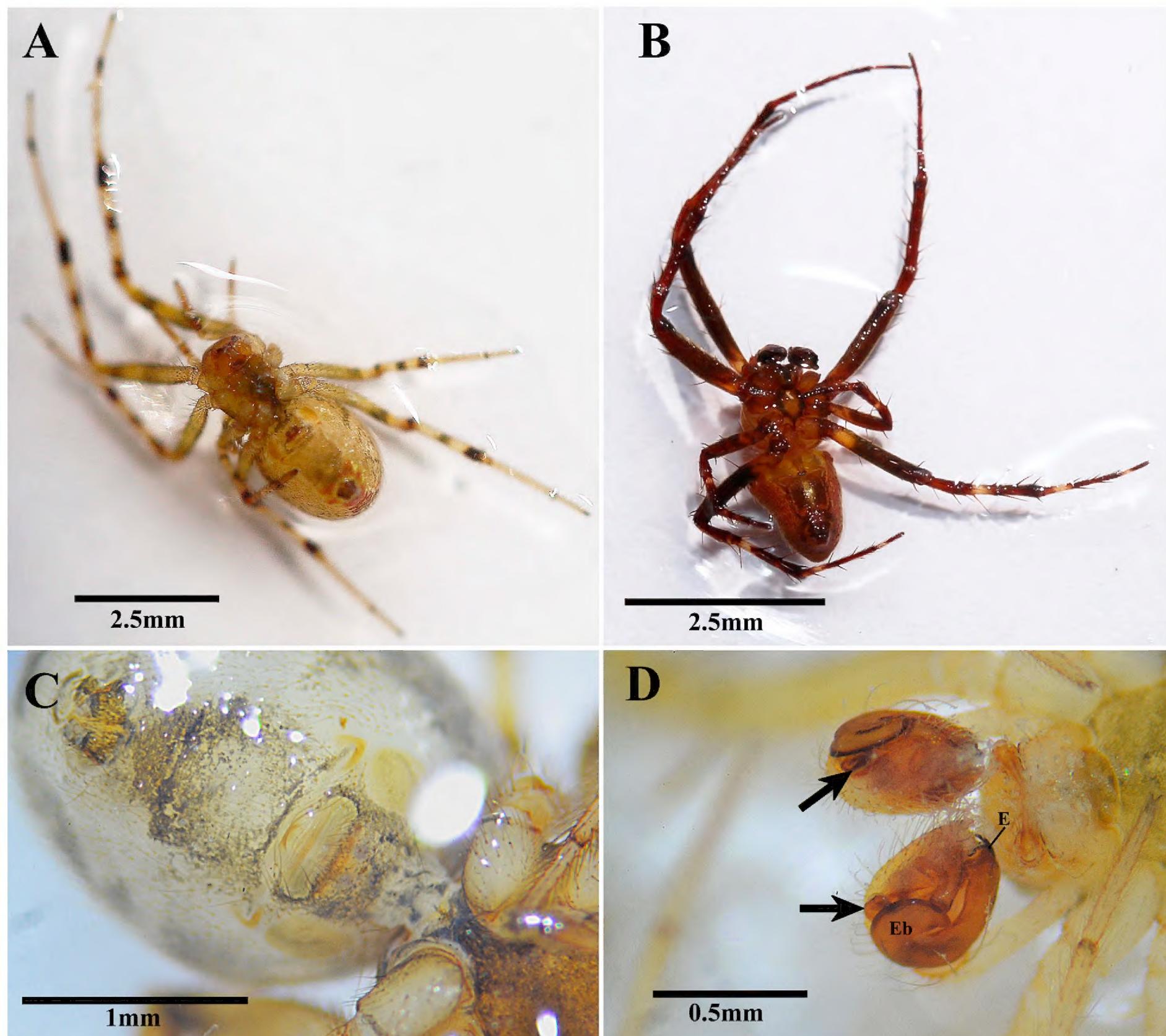


Figure 3. *Anelosimus jucundus*, genital detail. **A.** Adult Female ventral view. **B.** Adult Male ventral view. **C.** Epigynum. **D.** Male palp, note ectal outgrowth of the tegulum (black arrow), Eb = embolic division b, E = embolus.

Arachnology 27: 432–434.
 Keyserling E (1891) Die Spinnen Amerikas. Brasilianische Spinnen. Band 3. Nürnberg, Verlag von Bauer & Raspe, 278 pp. <https://doi.org/10.5962/bhl.title.64832>
 Levi HW (1956b) The spider genera *Neottiura* and *Anelosimus* in America (Araneae: Theridiidae). Transactions of the American Microscopical Society 75: 407–422.
 Levi HW (1963) The American spiders of the genus *Anelosimus* (Araneae, Theridiidae). Transactions of the American Microscopical Society 82: 30–48.
 Nentwig W, Christenson TE (1986) Natural history of the non-solitary sheetweaving spider *Anelosimus* cf. *jucundus* (Araneae: Theridiidae). Zoological Journal of the Linnean Society 87: 27–35.
 Pickard-Cambridge O (1896) [Arachnida. Araneida] In: Biologia Centrali-Americanana, zoology. Arachnida-Araneidea. Vol. 1. R. H. Porter, London, 161–224. <https://doi.org/10.5962/bhl.title.730>

Powers KS, Avilés L (2003) Natal dispersal patterns of a subsocial spider *Anelosimus* cf. *jucundus* (Theridiidae). Ethology 109: 725–737. <https://doi.org/10.1046/j.1439-0310.2003.00918.x>
 Simon E (1891) Observations biologiques sur les arachnides. I. Araignées sociables. In: Voyage de M. E. Simon au Venezuela (Décembre 1887–Avril 1888). 11^e Mémoire. Annales de la Société Entomologique de France 60: 5–14.
 Shorthouse DP (2010) SimpleMappr, an online tool to produce publication-quality point maps. <https://www.simplemappr.net>. Accessed on: 2019-08-21.
 Tapia Y, De Vries T (1980) Tolerancia y cooperación en la araña social *Anelosimus jucundus* del bosque tropical Río Palenque, Ecuador. Revista de la Universidad Católica, Quito 8: 51–74.
 World Spider Catalog (2019) World spider catalog, version 20.5. Natural History Museum Bern, Bern. <http://wsc.nmbe.ch>. Accessed on: 2019-05-07.